Cell Division Lab Activities

Part 1: Meiosis & Genetic Recombination

1. Review pp. S93-S96. You will view images of prepared slides.
2. Perform the appropriate calculations as shown on S95 but create a data table on separate paper.
3. Answer the questions: "Evaluating Results" 1-3 & "Where Can You Go from Here?" 1 & 3

- **Be sure to thoroughly discuss #1 in the evaluating results section**

Part 2: Loss of Cell Cycle Control

Go to the site below:
http://www.hhmi.org/biointeractive/eukaryotic-cell-cycle-and-cancer

Complete the guided worksheet on The Eukaryotic Cell Cycle and Cancer

Part 3: Case Study Analysis

Read the information below and complete the tasks that follow.

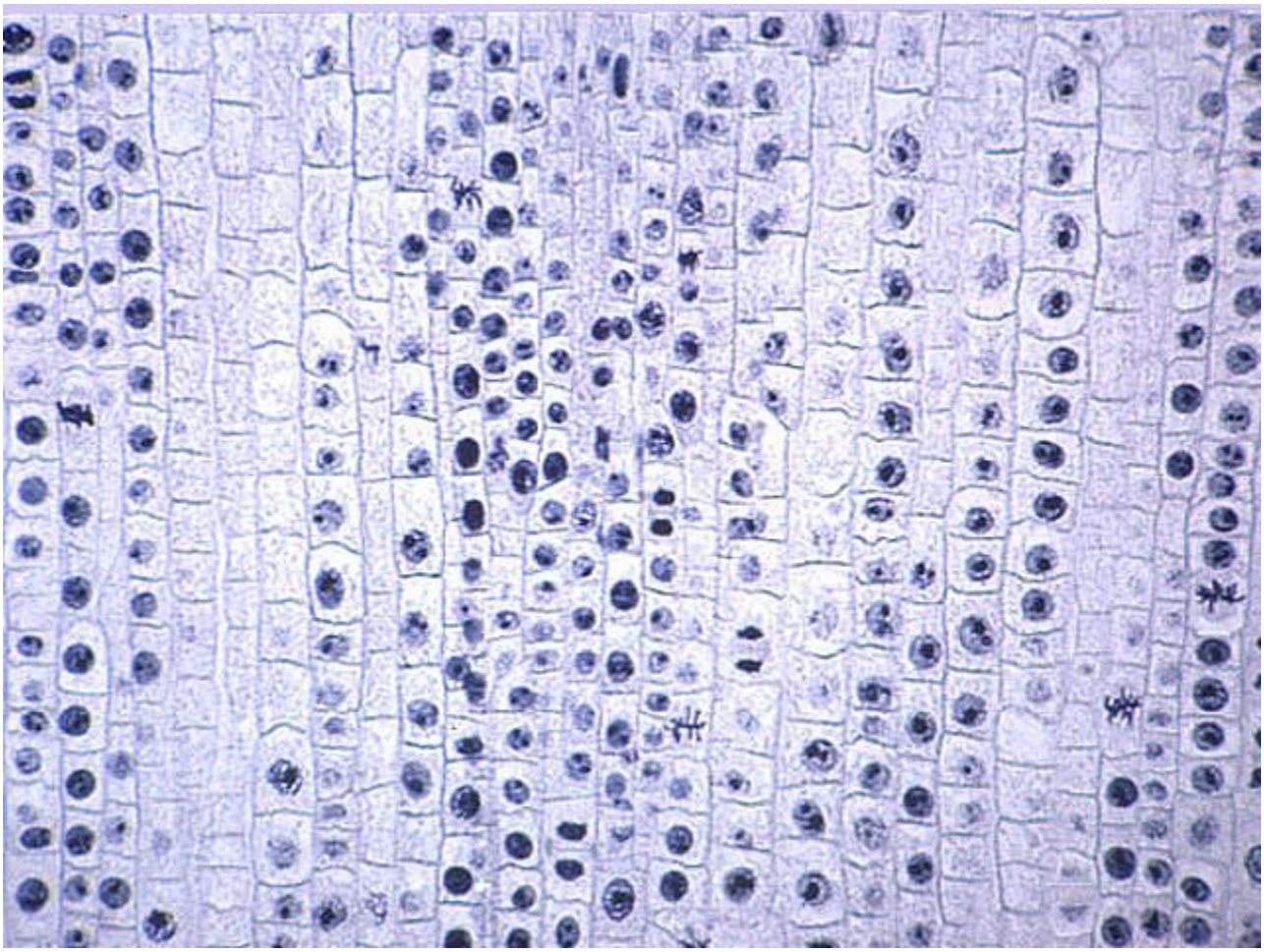
The Effect of Environmental Stimuli on Onion Cell Division

Introduction:

In an effort to increase production of onions as crops, scientists are studying how added natural environmental stimuli might increase onion root growth. Onion roots are small and increased root growth may lead to increased water and nutrient absorption. Scientists have also found fungal pathogens that grow in the soil can produce a lectin-like protein found in the area around the soybean roots. This protein may have been secreted by the fungus. Lectins in general induce mitosis in some root apical meristem tissues. Lectin may therefore be a promising chemical to add to the soil around onions to stimulate root growth and decrease time between plantings. In many instances however, rapid cell divisions induced by lectins weaken plant tissues. One alternative would to be to use a different chemical to stimulate root growth. One choice would be caffeine. Caffeine has a stimulating effect on some organisms and perhaps it could have some impact on cell reproduction.

Methods:

1. Onion roots were grown in water (control), lectin solution, or caffeine solution.
2. The onion tips were harvested and fixed by soaking in 1M HCl for 5 minutes, then 100% ethanol for 20 minutes. Toluidine blue was used to stain the cells.
3. The cells were counted using a Nikon digital light microscope; a sample is shown below.



Results

Table 1: Effects of water, lectin and caffeine on cells of onion root tips.

Tip Treatment	**Number of Cells**				
	Interphase	**Prophase**	**Metaphase**	**Anaphase/Telophase**	**Total**
Control	460	43	8	24	535
Lectin	417	117	51	41	626
Caffeine	330	9	3	0	342

Data Analysis
Your tasks are as follow:

1. For **each treatment** in table 1:
   a. Determine the frequencies of cells in dividing and non-dividing phases.
   b. Generate a pie graph of data for dividing & not dividing cells.

2. Below is a question that can be tested using this data.
   a. Propose a *null hypothesis* to test for the question.

      Question: Is caffeine a viable replacement for lectin to stimulate greater onion root cell growth?
      Null Hypothesis:

   b. Perform Chi Square analyses to test your hypothesis.
      1. For these analyses, the number of **treated** cells in interphase (non-dividing) and mitosis (dividing) will be the **observed** (o) values.
      2. To find out what your **expected** values are, complete the following steps:
         a. Calculate the percentage of cells in interphase and mitosis in the ***control*** group from Table 1.
         b. Multiply the percentages by the total number of cells in the ***treated*** group; this will give the expected numbers (e).
      3. Calculate the chi-square ($\chi 2$) value for the test.
      4. Compare this value to the critical value on your AP formula sheet
      5. The degrees of freedom (df) equals the number of groups minus one. In this case, there are two groups, interphase and mitosis; therefore, df = 2-1, or 1.
      6. The p value is 0.05, and the critical value is 3.84. If the calculated chi-square value is greater than or equal to this critical value, then the null hypothesis is rejected. If the calculated chi-square value is less than this critical value, the null hypothesis is accepted.

   c. Using the Chi Square tests and trends in the data, state whether your null hypothesis should be rejected or accepted.